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GRASP HAND APPROACH TO DETECT THE ATTENTIVENESS AND FATIGUE OF DRIVER VIA VIBRATION SYSTEM

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6.1. INTRODUCTION

Today modern living, transportation plays an important role in development of the country. However, the negative effect on a nation is the loss of life whereby the human factor life is considered priceless.

There are numerous gadget and safety systems installed on cars or vehicles. To name a few, Automatic Break System (ABS), Air Bag, Finger Print technology to activate car, Distance sensors and many more. All these are to prevent fatality during accidents or to prevent accidents from happening. The government for instance has launched so many road safety campaigns to road users and even the police had ongoing speed limit exercises for speedster in order to discourage driver from speeding. However, the result has not been encouraging. The system that I am proposing could in a way help reduces the increasing statistics of road accidents especially the fatigue car drivers which had also contributed in the road fatality statistic to increase.

Driver drowsiness is one of the major causes of serious traffic accidents. According to the National Highway Traffic Safety Administration (NHTSA) [1], there is about 56,000 crashes caused by drowsy drivers every year in US, which results in about

1,550 fatalities and 40,000 nonfatal injuries annually. The actual tolls may be considerably higher than these statistics, since larger numbers of driver inattention accidents caused by drowsiness are not included in above numbers [1]. The National Sleep Foundation also reported that 60% of adult drivers have driven while feeling drowsy in the past year, and 37% have ever actually fallen asleep at the wheel [2]. For this reason, a technique that can real-time detect the drivers' drowsiness is of utmost importance to prevent drowsiness-caused accidents. If drowsiness status can be accurately detected, incidents can be prevented by countermeasures, such as the arousing of driver and deactivation of cruise control.

Sleep cycle is divided into no rapid-eye-movement (NREM) sleep and rapid-eye-movement (REM) sleep and the NREM sleep are further divided into stages 1-4. Drowsiness is stage 1 of NREM sleep – the first stage of sleep [3]. A number of efforts have been reported in the literature on the developing of drowsiness detection systems for drivers.

Although it is a simple system but I believe in could help the fatigue drivers to deter them from road accidents.

6.2 STATISTIC OF EVIDENCE

Traffic accidents in Malaysia have been increasing at the average fatality index rate of 5.65 per 10,000 vehicles over the last a decade (see Table 6.1). Compared to the earlier years, total number of road accidents had increased from 215,632 cases in 1997 to 363,314 cases in 2007, reaching more than 68.48% increase of accident cases over 10 years.[4]

Table 1 Statistics reported by Malaysian Institute of Road Safety Research (MIROS)

Year	Vehicles Registered	Road Length (km)	Number of		Fatality Index		
			Accidents	Death	Per 10,000 Vehicles	Per 100,000 Population	Per Billion VKT
1997	8,550,469	63,382	215,632	6,302	7.37	29.1	33.57
1998	9,141,357	63,382	211,037	5,740	6.28	25.3	28.75
1999	9,929,951	64,981	223,166	5,794	5.83	25.5	26.79
2000	10,589,804	64,981	250,417	6,035	5.70	26.0	26.25
2001	11,302,545	64,981	265,175	5,849	5.17	25.1	23.93
2002	12,068,144	64,981	279,237	5,887	4.88	25.3	22.71
2003	12,868,934	71,814	298,651	6,282	4.88	25.1	22.77
2004	13,801,297	71,814	326,815	6,228	4.51	24.3	21.10
2005	14,816,407	72,400	328,268	6,200	4.18	23.7	19.58
2006	15,790,732	72,400	341,252	6,287	3.98	23.6	18.69
2007	16,825,150	72,400	363,314	6,282	3.73	22.8	17.60

6.2.1 Style of handling the steering according gender

There are three type of technique holding the steering that earn by Jabatan Keselamatan Jalan Raya Malaysia (JKJR) shown as below;



Figure 6.1 Technique 1 – Both hands hold the steering using 10-2 o'clock technique



Figure 6.2 Technique 2 – Single hands hold the steering using 2 o'clock technique



Figure 6.3 Technique 3 – Single hands hold the steering using 5 o'clock technique

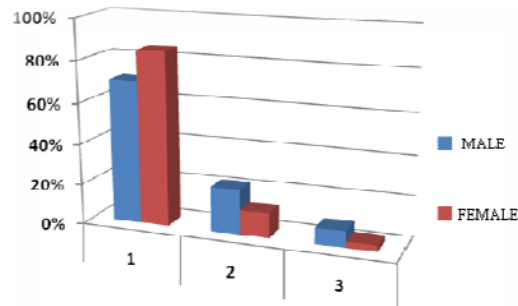


Figure 6.4 Statistic style of holding steering according gender.[4]

Based on three techniques, the graph was plotted according to gender (male and female) (see Figure 6.4). Technique 1 get the most higher statistic compare with other for both gender, 68% male and 82% female, follow with technique 2, but the percentage

much lesser compare with the first one, 19% male and 10% female. Technique 3 is the most lesser and record that 8% male and 3% female.

6.3. METHODOLOGY

The system contains two main functions:-

6.3.1 Transmission System

It consist of three main components and are synchronized together to produced inputs which is then encoded to the receiver using PT 2262 IC through radio frequency module

i) System Block Diagram

Figure 6.5 Safety system for car steering



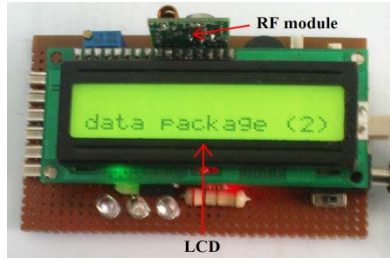


Figure 6.6 The complete transmitter module

ii) The steering wheel force sensor

The system designed in this work is based on pressure sensors such as the one shown in Figure 6.7.

The sensor strips are 24 inches long and 0.6 inches wide. The active area is 0.25 inches wide. They are polymer thick film (PTF) devices that exhibit a decrease in resistance when pressure is applied on their surface.



Figure 6.7: The Interlink FSR-408 flexiforce sensor.[5]

These thick film devices are printed on a flexible substrate that can be cut, folded, twisted and bent without any damage. They come with a self adhesive stripe on the back, which allows easy application to a wide range of surfaces. In our case, we attached four of these sensors on the perimeter of a steering wheel, as shown in Figure 6.7.

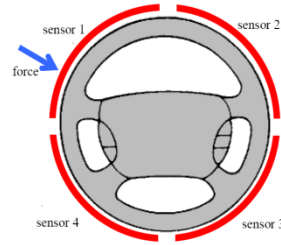


Figure 6.7 Sensor locations on the steering wheel

The sensors were cut to a length of about 12 inches and symmetrically placed on the circumference of the wheel, each covering one quarter of it. The sensors were connected to a simple amplifier circuit, consisting of a voltage divider, operational amplifier and some additional power stabilizing elements. The sensors are sensitive enough to record even slight taps. Taps can be used to perform a controlling action, e.g. to operate a device in the vehicle.

The results response for the sensor act by the hand grip shown as Figure 6.8,

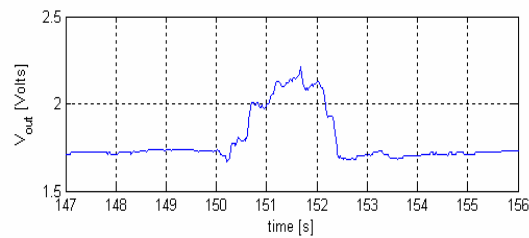


Figure 6.8 the response of hand pressure to the force sensor

It was expected that in near-accident driving situations the drivers would apply a higher gripping force on the steering wheel, in order to achieve better control over the vehicle. This was noticed only in some cases. V_{out} is a voltage signal which rises as the gripping force on the sensor rises.

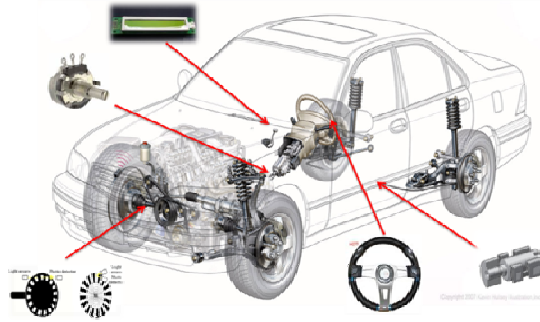


Figure 6.9 The main components that will be installed to the car

The flexiforce sensor which is installed at the steering wheel will detect the amount of holding pressure of the driver's hand. The current supply equivalent to 12V used for this sensor will be from the car battery via a converter. If the driver looses or higher grip on the steering wheel due to sleepiness or fatigue the resistance will be higher therefore triggering the seat vibration and voice activated warning. The potentiometer which is installed at the rudder of the steering would enable to detect the angle of the steering if the driver fall asleep and the steering sways. This will activate the LCD panel displaying the percentage of attentiveness of the driver. The rotary encoder which is connected to the speedometer ensures that the system only work if the car speed is above 40 Km/ hr. This is important as especially when the car is stagnant due to warming up of engine or stops at traffic lights.

6.3.2 Receiver System

The micro controller model PIC18F452 will be use to process the data received from the transmission system. The system input will derive from PT2272 IC that decodes the data.

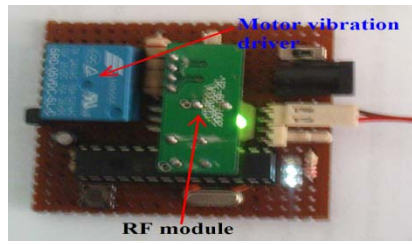


Figure 6.10 The complete Receiver module

When receiver module received the data, it will decode the data first then sent the data to the microcontroller. The vibrator and voice warning alert will activate on both occasions that is if the grip or pressure of driver's hand loosens and present speed detect by the rotary encoder is greater than 40km/h. These denote that the driver is in sleepy condition and LCD will at the same time display the percentage of driver's attentiveness.

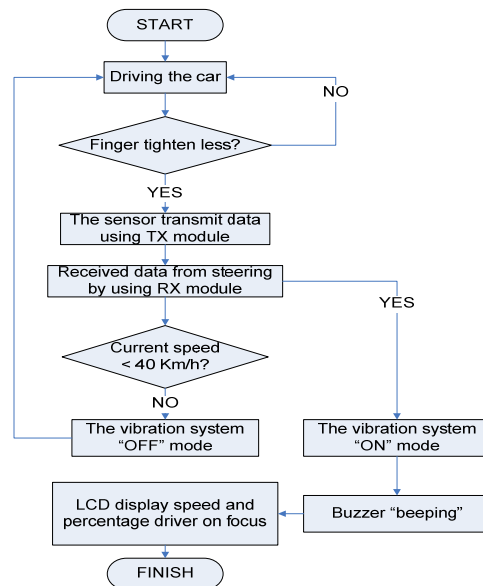


Figure 6.11: Flow chart for overall system

If the current speed of car is less then 40km/h, the system is in OFF mode and driver will continue the journey.

6.4 CONCLUSION

The above mentioned system was successfully done and tested by going through the approaches and methodology set in achieving the project objectives. Overall the system had a value added in bringing the safety features especially to sleepy head and fatigue drivers. The system will ensure that all car drivers to give their full attentiveness while driving on the road and not to take safety for granted as it will not only caused their lives but others too.

It is my sincere hope that when the system is well received by the public the percentage of road fatalities will fall tremendously and thus making our roads a safe passage to all our destinations. The system may be a reminder to all drivers that they should be in the best of alertness when they are behind the wheels or otherwise the system will automatically remind them.

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